DATA FROM LIFE HISTORY

Robert Humphreys

PIFSC, FRMD, Life History Program

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NOAA FISHERIES

MAJOR SPECIES GROUPS

Coral Reef Fishes: Acanthuridae, Scaridae, Lethrinidae, Mullidae, Holocentridae, Siganidae, *Lutjanus*

Deep-slope Bottomfish: Eteline snappers, Epinepheline groupers, Carangidae

Pelagics: Xiphiidae, Istiophoridae, Bramidae, Coryphaenidae, *Acanthocybium*, *Lampris*

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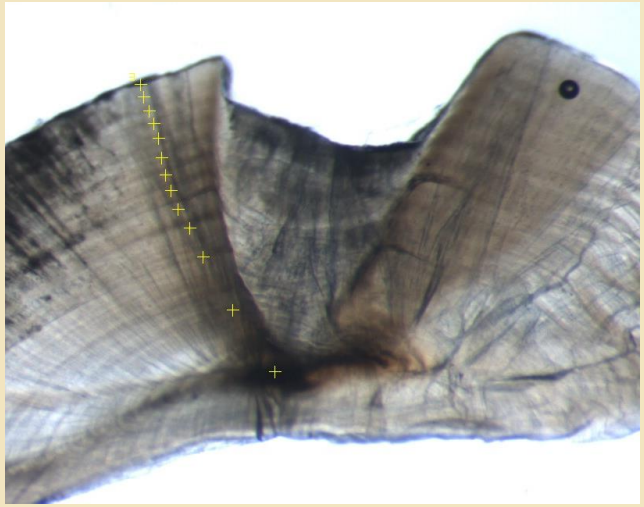
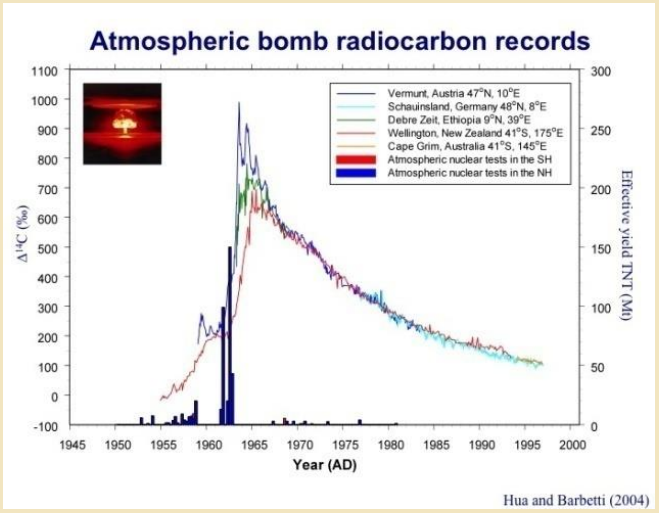
AGE DETERMINATION

- **Based on sagittal otoliths**
- **von Bertalanffy length-at-age growth curves**
- **Longevity estimates (A_{max})**

ANNUAL GROWTH ZONES



BOMB RADIOCARBON



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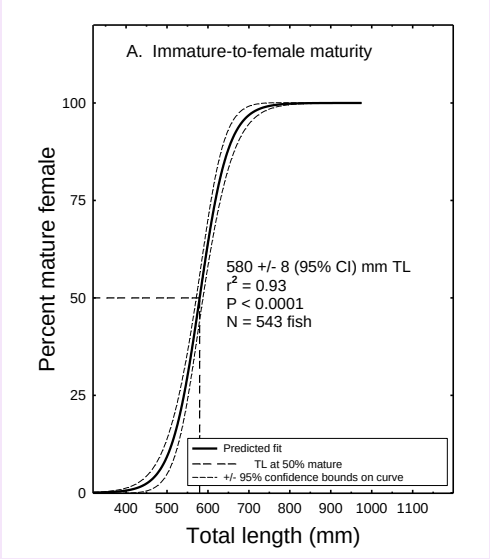
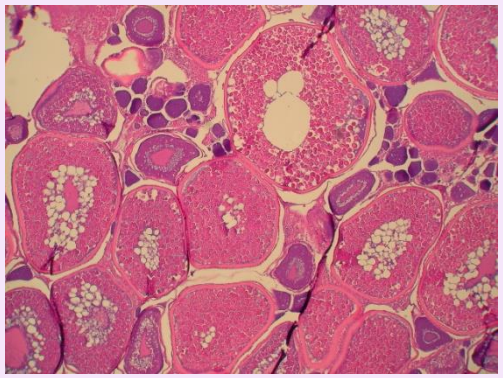
REPRODUCTION

- **Based on gonad histology**
- **Length at 50% maturity (L_{50})**
- **Age at 50% maturity (A_{50})**
- **Length/age at 50% sex reversal (L_X and A_X)**
- **Spawning period**





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USE IN PIFSC STOCK ASSESSMENTS

Von Bertalanffy growth curve:

- Growth is a fundamental measure of stock productivity
- Growth parameters are needed for and can be applied to all species for:
  - Productivity/ Susceptibility Analyses
  - Length-based mortality estimators
  - Age-structured stock assessments

Longevity (A_{max}):

- Indicator of population turnover and natural mortality rates for stock assessment

USE IN PIFSC STOCK ASSESSMENTS

Maturity Ogives and Median (50%) Length & Age at Maturity (L_{50} &A_{50}):

- Needed to calculate reproductive output
- Considered in formulating size limits and seasonal fishing restrictions

Length-Weight Relationship:

- Needed to convert length to weight and vice versa

CORAL REEF FISH & BOTTOMFISH

Bio-Sampling Program: American Samoa, CNMI, Guam
NOAA Vessels & Local Markets: Hawaii

Bio-Sampling in Western Pacific:

- Regional species priority list for biological sampling
- Arrangements with markets to sample fish
- Priority fish brought to bio-sampling facility for otolith & gonad extraction (~20 specimens/length class/month/species)
- NOAA research cruises support bottomfish sample collection

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PELAGICS

PIRO Observer Program: samples Hawaii and American Samoa pelagic longline fishery

Bio-Sampling Program: currently no sampling

Biological Sampling Procedures:

- At-sea sampling by trained PIRO contracted observers
- Observers sample according to written protocols
- Record capture data and measure length
- Collect/preserve/label heads (otoliths) and gonads

CORAL REEF FISH – Contracted Study

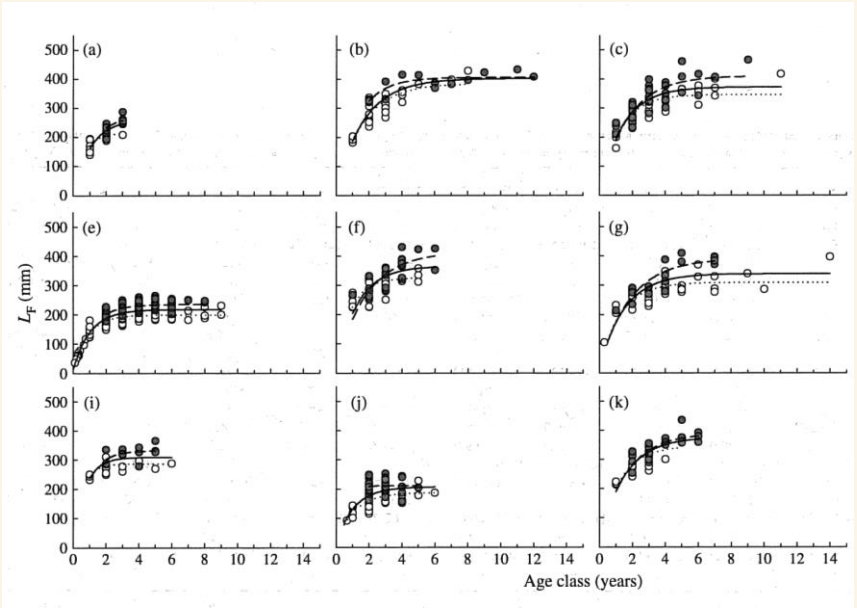
Parrotfish species – Guam

Calatomus carolinus

Chlorurus frontalis, C. microrhinos,* and *C. spilurus

Scarus altipinnis, S. forsteni, S. psittacus, S. rubroviolaceus,* and *S. schlegeli

L_{50}, L_X, & L_{max} and A_{50} & A_{max} determined for 9 species (Taylor & Choat 2014 *J. Fish. Biol.*)



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CORAL REEF SPECIES –LOBSTERS

Past NWHI fishery for:
Spiny Lobsters *Panulirus marginatus*
Slipper Lobster *Scyllarides sqammosus*

Key Life History Findings:

- Growth varied among islands for both species
- Developed morphological proxy for L_{50}
- Mortality estimates based on tag/recapture data
- Range of movement limited for both species (<0.5 km)
- Compensatory response in reproductive parameters

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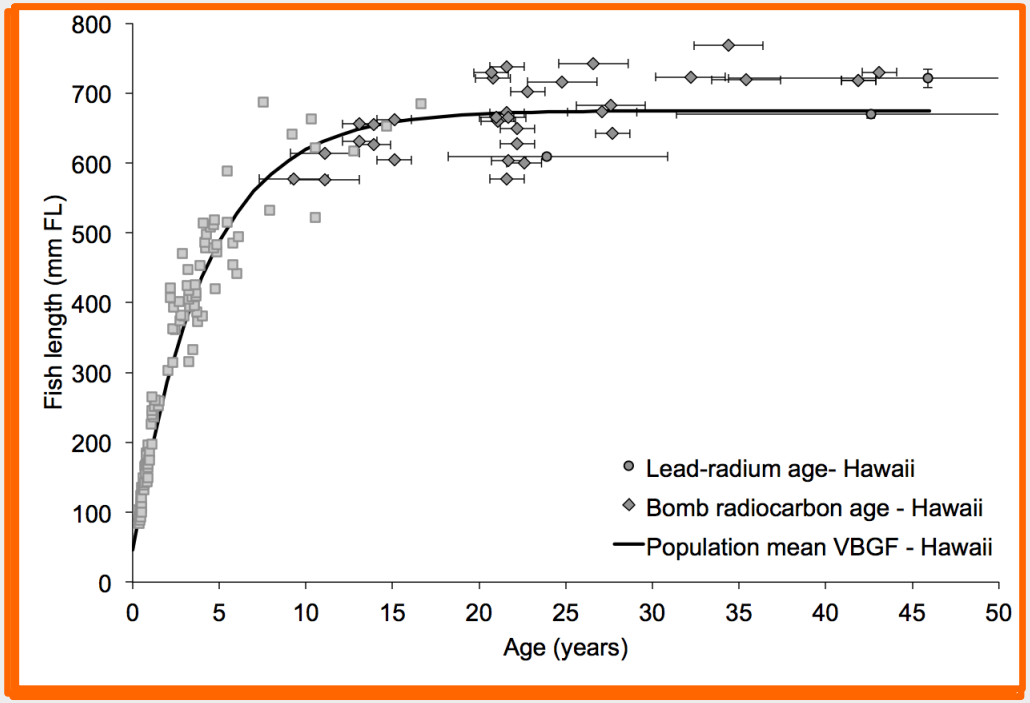
DEEP-SLOPE BOTTOMFISH

Pristipomoides filamentosus
(Opakapaka)

Early growth studies indicated A_{max} ~18 yrs

Recent study that included radiochemical techniques reveal A_{max} ~43 yrs



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PELAGICS – HI based Longline Fishery

Swordfish, *Xiphias gladius*

Age & Growth:

- Reach 98 cm EFL by age-1
- Females-faster growth rates
- A_{max} ~ 12 years

Reproductive Maturity:

- Males:

  L_{50} =102 cm EFL at A_{50} ~1 yr
- Females:

  L_{50} =144 cm EFL at A_{50} ~4-5 yrs

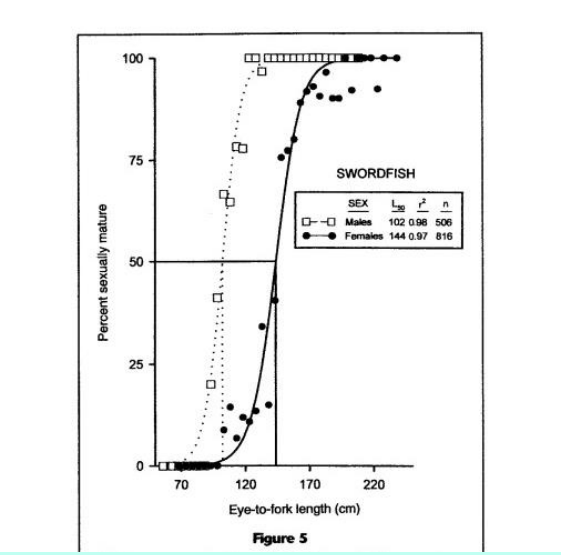
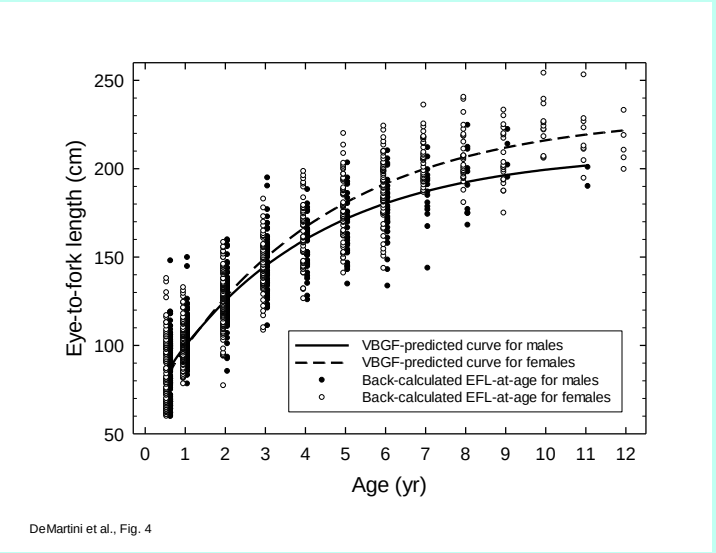


Figure 5



DeMartini et al., Fig. 4

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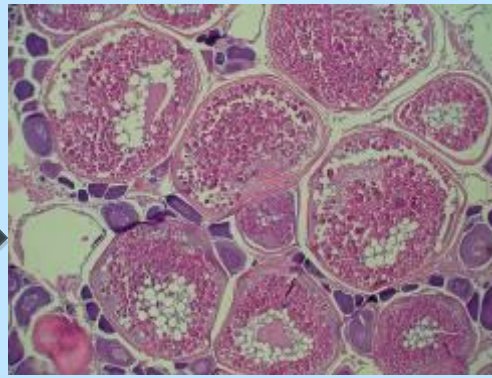
TIMELINE OF LIFE HISTORY STUDIES

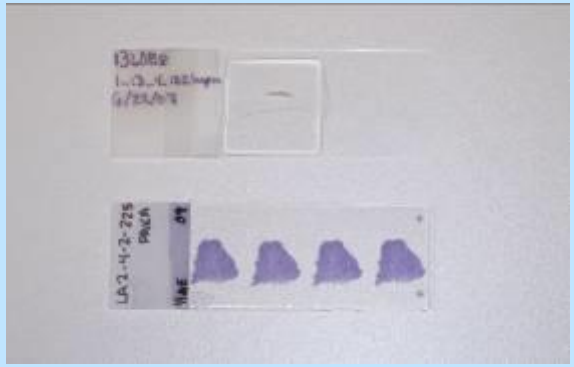
Sampling: 1-2 yr

Otolith prep:
0.5-1 yr

Gonad prep:
0.5-1 yr



Lab Analysis:
0.5-1.5 yr



Data Analysis & Results:
~0.5 yr

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TROPICAL FISH LIFE HISTORY Challenges

1. Vast majority of insular species are data-poor
2. Limited access; low landings; cultural preferences; high market value
3. Many species suspected to be long-lived (A_{max} >30 yrs)
4. Four species groups are "sex-switchers"
5. Regional variation in life history parameters likely
6. Remote sampling locations
7. Limited regional capacity to conduct life history studies; small PIFSC Life History Program

➢ <u>"Production Level Ageing" on even 1 species is not feasible</u>

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LIFE HISTORY PROXIES: Provide More Timely Estimates for Bio-Sampled Coral Reef Fishes

<u>OBJECTIVE</u>: Develop a new way to expedite estimates of fem L_{50} & A_{50} with acceptable accuracy & precision

1. Using Bio-Sampling database, plot monthly female GSIs vs. FL
2. Identify peak GSI month & ≥½ peak months as spawning season
3. Select ovary samples over size range of spawning season
4. Prepare & score individual maturity using histological slides
5. Fit logistic to % mature per length class to estimate L_{50}
6. Select otoliths; have contractor prepare & age cross-sections
7. Estimate A_{50} from age estimates in step 6
8. Iteratively solve for GSI L_{50} that corresponds to histology L_{50}

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CURRENT STATUS OF LIFE HISTORY PROXY STUDIES

AMERICAN SAMOA

Bigscale soldierfish *Myripristis berndti*: prelim L_{50} fit for n≈110

Blueline squirrelfish *Sargocentron tiere*: prelim L_{50} fit for n≈115

CNMI

Pacific yellowtail emperor *Lethrinus atkinsoni*: L_{50} fit (n=556)

Bluespine unicornfish *Naso unicornis*: histology done but slides unread (n≈350-370 available); size-at-age estimated for n=25

GUAM

Bigeye emperor *Monotaxis grandoculis*: prelim L_{50} fit for n≈90

Lyretail grouper *Variola louti*: prelim L_{50} fit for n≈90

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TRADEOFFS OF LIFE HISTORY "PROXIES"

POSITIVES:

- Cost effective; acceptable approach given limited staff
- Information needs of stakeholders & assessment scientists provided on a more timely basis for more spp.

NEGATIVES:

- Limited to females
- Full success contingent on ability to empirically develop predictive relation between GSI-based L_{50} & histology-based L_{50}
- Errors introduced during field sampling can cause delays, lessen accuracy and precision (fewer usable specimens)

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LIFE HISTORY – NEXT 5 YEARS


initial phase

Primarily coral reef and bottomfish species in the western & central Pacific

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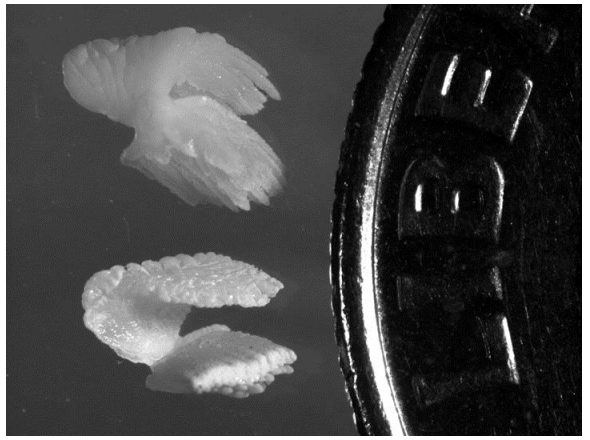
POTENTIAL FUTURE APPLICATIONS
Other Marine Fishes

Blue marlin (1245 lbs.)
Oahu 2009



Opah, *Lampris spp.*

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LH PUBLICATIONS (2000-present)

Pelagics:

DeMartini et al. (2007). Fish Bull 105:356-367

DeMartini et al. (2000). Fish Bull 98:489-500

Lobster:

DeMartini. (2006). Atoll Res Bull 543:203-215

DeMartini et al. (2005). Fish Bull 103:23-33

DeMartini et al. (2003). Fish Bull 101:22-31

DeMartini et al. (2002). NOAA-TM-NMFS-SWFSC-344

DeMartini & Williams. (2001). J Crust Biol 21:891-896

O'Malley & Walsh. (2012). Bull Mar Sci 89:529-549

O'Malley. (2011). Mar Biol 158:1887-1901O'Malley. (2009). Mar Coast Fisheries 1:325-342

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LH PUBLICATIONS (2000-present)

Bottomfish:

Andrews et al. (2012). Can J Fish Aquat Sci 69:1850-1869

Andrews et al. (2011). PIFSC Admin Rep H-11-07

DeMartini et al. (2011). Fish Bull 109:123-134

Nichols & DeMartini. (2008). PIFSC Admin Rep H-08-06

Reef fish:

Andrews et al. (submitted March 2014). Mar FW Res

Andrews et al. (2013). Mar F W Res 70(8):1131-1140

Andrews et al. (2011). Mar F W Res 62(11):1259-1269

DeMartini et al. (2014). Ichthyol Res DOI 10.1007/s10228-014-0393-z

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